UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,525	03/01/2004	John R. Rosenlof	TI-36348	2775

23494 7590 01/31/2008
TEXAS INSTRUMENTS INCORPORATED
P O BOX 655474, M/S 3999
DALLAS, TX 75265

EXAMINER	
YOUNG, JANELLE N	
ART UNIT	**PAPER NUMBER**
2618	
NOTIFICATION DATE	**DELIVERY MODE**
01/31/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@ti.com
uspto@dlemail.itg.ti.com

Office Action Summary	Application No.	Applicant(s)	
	10/790,525	ROSENLOF ET AL.	
	Examiner	Art Unit	
	Janelle N. Young	2618	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 November 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6-14,16-21,23-31 and 33-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4, 6-14, 16-21, 23-31,33-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 January 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-13 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Appel et al. (US Patent 6272336), Yun (US Patent 6463295), Wright et al. (US Patent 6054894) and further in view of Agee et al. (US Pub 2004/0095907).

AS for claim 1, Appel et al. discloses a power control circuit for controlling the combined effective DC bias current of a bank of parallel RF power amplifiers disposed in the transmit path of an RF transmitter. The power control circuit comprises: 1) a first signal monitor for monitoring the level of a modulated RF output signal; and 2) an amplifier bias current controller for comparing the modulated RF output signal level and a known maximum output power parameter of the active RF power amplifiers to determine if the active RF power amplifiers are operating in the linear region. If the active RF power amplifiers are operating in or near the nonlinear region, the power control circuit enables one or more inactive RF power amplifiers to increase the effective combined DC bias current and linearity of the active RF power amplifiers. Conversely, if the active RF power amplifiers are operating well within the linear region,

the power control circuit may disable one or more active RF power amplifiers in order to reduce the effective combined DC bias current of the active RF power amplifiers and save power. In addition, Appel et al. teaches a power detector detects power of a transmitter output signal and that provides an indication of power for the ~~associated with~~ a transmitter output signal (Abstract; Col. 1, lines 7-10; Col. 6, lines 10-30; Col. 6, line 66-Col. 7, line 14; and Col. 7, lines 46-65 of Appel et al.); and a compensation system that employs the indication of power to compensate for at least one transmitter impairment affecting the transmitter output signal (Col. 6, line 66-Col. 7, line 14 of Appel et al.).

What Appel et al. does not explicitly teach is the determining weights; frequency offset correction; equalization; demodulation; mitigating channel interference; using a pilot tone; and in one embodiment of the present invention, signal quality estimation.

However, Yun teaches a method for ongoing power control for a communication station with a multiple antenna array, the power control using a method for signal quality estimation applicable for angle modulated signals. One aspect of the ongoing power control method is applicable for the uplink and includes separating the joint determination of a receive weight vector and ongoing power control into a receive weight vector determining part and a separate transmit power adjustment part. In one embodiments, the ongoing power control method for the downlink includes separating the joint determination of a receive weight vector and ongoing power control into a receive weight vector determining part and a separate transmit power adjustment part. The method starts with one part, for example transmit power assignment. Receive

weight vector determination is carried out with this assigned transmit power and the new weights used. An estimate of the resulting received signal quality is obtained and used for new ongoing power adjustment. Another aspect is applicable for the downlink and includes one aspect of the ongoing power control method is applicable for the uplink and includes separating the determination of a complete transmit weight vector including the vector of relative transmit weights and the scaling to use with the relative transmit weights into a part for determining a set of relative transmit weights and a separate transmit power adjustment part that determines the scaling factor.

What Appel et al. and Yun do not explicitly teach are the correcting impairments; a phase imbalance; and adjusting for any bulk gain mismatch.

However, Wright et al. discloses the mismatch correction and a control that can adjust one or both of I and Q signal components; correcting impairments; and reducing distortion. The inventive LINC amplifier provides substantially linear amplification from two nonlinear amplifiers by decomposing the original signal into two constant amplitude envelope, phase varying signals, which, when combined, constructively and destructively interfere to re-form the original signal. The output of the LINC amplifier, which is to be transmitted via an antenna, is an amplified form of the original signal. The inventive LINC amplifier utilizes a digital control mechanism to control and adapt a digital compensation network that directly compensates for the imperfections of the analog RF environment, including the amplifiers. The mechanism monitors the combined amplifier output and adjusts the signal components in order to precisely compensate for any differences in the characteristics of the separate signal paths which

would cause the combination not to accurately represent the original signal. The mechanism also corrects the component signals using information which can be applied to the amplifiers independent of the signal to be transmitted.

What Appel et al., Yun, and Wright et al. do not explicitly teach is an equalization system and an OFDM tones.

Agee et al. teaches exploiting the substantive reciprocity of internode channel responses through dynamic, adaptive modification of receive and transmit weights, enables locally enabled global optimization of a multipoint, wireless electromagnetic communications network of communication nodes. Each diversity-channel-capable node uses computationally efficient exploitation of pilot tone data and diversity-adaptive signal processing of the weightings and the signal to further convey optimization and channel information which promotes local and thereby network-global efficiency. The preferred embodiment performs complex digital signal manipulation that includes a linear combining and linear distribution of the transmit and receive weights, the generation of piloting signals containing origination and destination node information, as well as interference-avoiding pseudorandom delay timing, and both symbol and multitione encoding, to gain the benefit of substantive orthogonality at the physical level without requiring actual substantive orthogonality at the physical level. In addition, Agee et al. teaches <u>an equalization system that adjusts tones in a signal spectrum employed to provide the transmitter output signal so that the signal spectrum has a desired spectral shape, the equalization system adjusting the tones in the signal spectrum during calibration based on the indication of power</u> (Page 13, Para 0127-0128; Page 16,

Para 0173; Page 19, Para 0210; Pages 24-25, Para 0270-0271; Page 33, Para 0398; Page 34, Para 0429; Page 35, Para 0453-0454; Pages 35-36, Para 0462-0465 of Agee et al.).

It would have been obvious to one of ordinary skill of the art at the time the invention was made to incorporate a network that employs power control system, as taught by Yun, in the traffic-weighted closed loop power detection system of Appel et al., because Appel et al. already teaches a power control circuit for controlling the transmitter output signal; correction systems; in-phase and quadrature signal; and compensation of power level (Abstract of Appel et al.).

The motivation of this combination would adjusts the power reference signal to compensate for changes in operating temperature and/or frequency and reduce power consumption, as taught by Appel et al. in Col. 10, lines 15-35, in order to maintain constant gain in the transmit path. In addition, the power control would compensate the initial power control and ongoing power control. In initial power control, the goal is to initiate communications with the minimal level of power necessary to achieve an acceptable level of communications. Ongoing power control maintains minimum transmitted power usage on a link as the communication system changes over time by new links being formed while others are being established (Col. 1, lines 42-50 of Yun). With the power amplifier bias or power amplifier enable control signal unaffected by the distortion and the amplifiers can be smaller, cooler, more power efficient and less expensive. The preferred method of signal generation is to use digital techniques as much as possible to reduce distortions (Wright et al.). Appel et al., Yun, Wright et al.,

and Agee et al. each teach power amplifiers to compensate and/or reduce distortions/spikes in signal paths for a communication system and can further limit or reduce interference received at base stations or subscriber units (Page 2, Para 0017 of Agee et al.).

As for claim 2, Appel et al. teaches a correction system comprising: the compensation system being configured to selectively adjust at least one of an in-phase (I) signal component and a quadrature (Q) signal component based on the indication of power to mitigate distortion characteristics in the transmitter output signal (Col. 7, line 65-Col. 9, line 45 of Appel et al.).

As for claim 3, Appel et al. teaches a correction system comprising: the indication of power further comprising a relative power measured by the power detector associated with the respective I and Q signal components (Col. 7, line 65-Col. 9, line 45 of Appel et al.).

As for claim 4, Appel et al. and Wright et al. teach a correction system comprising: the compensation system further comprising a carrier correction system that adjusts DC offset of at least one of an in-phase (I) signal component and a quadrature (Q) signal component utilized to provide the transmitter output signal based on the indication of power to mitigate spikes in the carrier level of the transmitter output signal (Col. 7, line 65-Col. 9, line 45 of Appel et al. with respect to Col. 7, lines 22-65; Col. 8, lines 3-27; Col. 14, line 38-Col. 15, line 5; and Col. 37, line 66-Col. 38, line 9 of Wright et al.).

Claim 5, cancelled.

As for claim 6, Yun teaches a correction system comprising: the equalization system selectively weighting tones in the signal spectrum based on an indication of power associated with the tones in the signal spectrum relative to an indication of power associated with a reference tone in the signal spectrum (Col. 16, lines 15-55 and Col. 18, line 58-Col. Col. 19, line 50 of Yun).

As for claim 7, Yun teaches a correction system further comprising:

a comparator that compares a power characteristic associated with each of the tones in the signal spectrum relative to a power characteristic of the reference tone to provide an indication of relative power for each respective tone (Col. 16, lines 15-55 and Col. 18, line 58-Col. Col. 19, line 50 with respect to Col. 23, line 58-Col. 24, line 20 of Yun); and

a weighting function that employs the indication of relative power for each respective tone to adjust each respective tone to a desired level relative to the reference tone (Col. 10, line 3-Col. 11, line 39 of Yun).

As for claim 8, Yun teaches a correction system comprising: the weighting function being applied to adjust at least one of the I-signal component and the Q-signal component of the transmitter output signal to provide the desired spectral shape (Col. 37, line 31-Col. 38, line 31 of Yun).

As for claim 9, Appel et al. teaches a correction system comprising: further comprising a detector bias component configured to determine a DC bias associated with operation of the power detector, the compensation system employing the DC bias

to mitigate effects of the DC bias in the indication of power (Abstract and Col. 6, line 56-Col. 7, line 40 of Appel et al.).

As for claim 10, Appel et al. teaches a correction system comprising: the compensation system is operative to adjust at least one of an in-phase (I) signal component and a quadrature (Q) signal component based on the indication of power to compensate for at least one of a gain and phase mismatch between a signal path for the I-signal component and a signal path for the Q-signal component (Col. 7, line 65-Col. 9, line 45 of Appel et al.).

As for claim 11, Wright et al. teaches a correction system comprising: further comprising a mismatch correction system operative to ascertain an indication of at least one of a gain and phase mismatch between an in-phase (I) signal component and a quadrature (Q) signal component based on the indication of power, the mismatch correction system adjusting at least one of the I-signal component and the Q-signal component based on the indication of the mismatch between I and Q signal components (Col. 13, lines 36-51 and Col. 42, line 56-Col. 43, line 48 of Wright et al.).

As for claim 12, Appel et al. teaches a correction system comprising: the mismatch correction system further comprising: a comparator that compares the indication of power associated with the I-signal component and the indication of power associated with Q-signal component to provide an indication of relative power characteristics corresponding to the mismatch associated with a signal path for the I-signal component and a signal path for the Q-signal component and a control operative

to adjust at least one of the I and Q signal components based on the indication of the relative power characteristics (Col. 7, line 46-Col. 10, line 4 of Appel et al.).

Regarding claim 13, see explanation as set forth regarding claim 1 (system claim) because the claimed integrated circuit for a correction would perform the system steps.

As for claim 34, Agee et al. teaches a correction system wherein the transmitter output signal is an orthogonal frequency division multiplexing (OFDM) signal (Page 13, Para 0127-0128; Page 16, Para 0173; Page 19, Para 0210; Pages 24-25, Para 0270-0271; Page 33, Para 0398; Page 34, Para 0429; Page 35, Para 0453-0454; Pages 35-36, Para 0462-0465 of Agee et al.).

2. Claims 14-20 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Appel et al. (US Patent 6272336), Yun (US Patent 6463295), Wright et al. (US Patent 6054894) and further in view of Agee et al. (US Pub 2004/0095907).

As for claim 14, Appel et al. teaches a communications apparatus comprising: a baseband system that provides in-phase (I) and quadrature (Q) signal components; a correction system associated with the baseband system for adjusting at least one of the I and Q signal components based on an indication of power of a transmit signal to compensate for impairments associated with the communications apparatus; a transmitter that provides the transmit signal based on the adjusted I and Q signal components; and a power detector that detects power associated with the transmit

signal and provides the indication of power (Abstract and Col. 7, line 46-Col. 10, line 45 of Appel et al).

What Appel et al. does not explicitly teach is the determining weights; frequency offset correction; equalization; demodulation; mitigating channel interference; using a pilot tone; and in one embodiment of the present invention, signal quality estimation.

However, Yun teaches a method for ongoing power control for a communication station with a multiple antenna array, the power control using a method for signal quality estimation applicable for angle modulated signals. One aspect of the ongoing power control method is applicable for the uplink and includes separating the joint determination of a receive weight vector and ongoing power control into a receive weight vector determining part and a separate transmit power adjustment part. In one embodiments, the ongoing power control method for the downlink includes separating the joint determination of a receive weight vector and ongoing power control into a receive weight vector determining part and a separate transmit power adjustment part. The method starts with one part, for example transmit power assignment. Receive weight vector determination is carried out with this assigned transmit power and the new weights used. An estimate of the resulting received signal quality is obtained and used for new ongoing power adjustment. Another aspect is applicable for the downlink and includes one aspect of the ongoing power control method is applicable for the uplink and includes separating the determination of a complete transmit weight vector including the vector of relative transmit weights and the scaling to use with the relative

transmit weights into a part for determining a set of relative transmit weights and a separate transmit power adjustment part that determines the scaling factor.

What Appel et al. and Yun do not explicitly teach are the correcting impairments; a phase imbalance; and adjusting for any bulk gain mismatch.

However, Wright et al. discloses the mismatch correction and a control that can adjust one or both of I and Q signal components; correcting impairments; and reducing distortion. The inventive LINC amplifier provides substantially linear amplification from two nonlinear amplifiers by decomposing the original signal into two constant amplitude envelope, phase varying signals, which, when combined, constructively and destructively interfere to re-form the original signal. The output of the LINC amplifier, which is to be transmitted via an antenna, is an amplified form of the original signal. The inventive LINC amplifier utilizes a digital control mechanism to control and adapt a digital compensation network that directly compensates for the imperfections of the analog RF environment, including the amplifiers. The mechanism monitors the combined amplifier output and adjusts the signal components in order to precisely compensate for any differences in the characteristics of the separate signal paths which would cause the combination not to accurately represent the original signal. The mechanism also corrects the component signals using information which can be applied to the amplifiers independent of the signal to be transmitted. In addition, Wright et al. teaches a correction system associated with the baseband system for adjusting at least one of the I and Q signal components based on an indication of power of a transmit signal to compensate for impairments associated with the communications apparatus

wherein the correction system further comprising a carrier correction system that adjusts a level of at least one of the I and Q signal components based on the indication of power to compensate for an impairment associated with the communications apparatus that affects a level of the carrier signal in the transmit signal (Col. 8, lines 3-27 and Col. 37, line 66-Col. 38, line 9 of Wright et al.)

What Appel et al., Yun, and Wright et al. do not explicitly teach is an equalization system and an OFDM tones.

Agee et al. teaches exploiting the substantive reciprocity of internode channel responses through dynamic, adaptive modification of receive and transmit weights, enables locally enabled global optimization of a multipoint, wireless electromagnetic communications network of communication nodes. Each diversity-channel-capable node uses computationally efficient exploitation of pilot tone data and diversity-adaptive signal processing of the weightings and the signal to further convey optimization and channel information which promotes local and thereby network-global efficiency. The preferred embodiment performs complex digital signal manipulation that includes a linear combining and linear distribution of the transmit and receive weights, the generation of piloting signals containing origination and destination node information, as well as interference-avoiding pseudorandom delay timing, and both symbol and multitione encoding, to gain the benefit of substantive orthogonality at the physical level without requiring actual substantive orthogonality at the physical level.

It would have been obvious to one of ordinary skill of the art at the time the invention was made to incorporate a network that employs power control system, as

taught by Yun, in the traffic-weighted closed loop power detection system of Appel et al., because Appel et al. already teaches a power control circuit for controlling the transmitter output signal; correction systems; in-phase and quadrature signal; and compensation of power level (Abstract of Appel et al.).

The motivation of this combination would adjusts the power reference signal to compensate for changes in operating temperature and/or frequency and reduce power consumption, as taught by Appel et al. in Col. 10, lines 15-35, in order to maintain constant gain in the transmit path. In addition, the power control would compensate the initial power control and ongoing power control. In initial power control, the goal is to initiate communications with the minimal level of power necessary to achieve an acceptable level of communications. Ongoing power control maintains minimum transmitted power usage on a link as the communication system changes over time by new links being formed while others are being established (Col. 1, lines 42-50 of Yun). With the power amplifier bias or power amplifier enable control signal unaffected by the distortion and the amplifiers can be smaller, cooler, more power efficient and less expensive. The preferred method of signal generation is to use digital techniques as much as possible to reduce distortions (Wright et al.). Appel et al., Yun, Wright et al., and Agee et al. each teach power amplifiers to compensate and/or reduce distortions/spikes in signal paths for a communication system and can further limit or reduce interference received at base stations or subscriber units (Page 2, Para 0017 of Agee et al.).

Claim 15, cancelled.

As for claim 16, Yun teaches a communications apparatus comprising: the correction system further comprising an equalization system that adjusts tones in a signal spectrum corresponding to the transmit signal based on the indication of power so that the signal spectrum has a desired spectral shape (Col. 27, lines 17-38; Col. 31, lines 30-53; Col. 35, lines 30-54; Col. 36, lines 11-30; and Col. 45, lines 26-31 & 35-58 of Yun).

As for claim 17, Yun teaches a communications apparatus comprising: the equalization system selectively weighting tones in the signal spectrum based on an indication of power associated with the tones in the signal spectrum relative to the indication of power associated with a reference tone in the signal spectrum (Col. 27, lines 17-38; Col. 31, lines 30-53; Col. 35, lines 30-54; Col. 36, lines 11-30; and Col. 45, lines 26-31 & 35-58 of Yun).

As for claim 18, Wright et al. teaches a communications apparatus comprising: the correction system further comprising a of Wright et al. correction system operative to ascertain, based on the indication of power, an indication of mismatch associated with a signal path for the I-signal component and a signal path for the Q-signal component, the mismatch correction system adjusting at least one of the I-signal component and the Q-signal component based on the indication of the mismatch between I and Q signal components (Col. 13, lines 36-51 and Col. 42, line 56-Col. 43, line 48 of Wright et al.).

As for claim 19, Wright et al. teaches a communications apparatus comprising: wherein the mismatch further comprises at least one of a phase imbalance and a gain

mismatch caused by circuitry in the signal path for the I-signal component and the signal path for the Q-signal component (Col. 7, lines 40-65 and Col. 42, line 56-Col. 43, line 48 of Wright et al.).

Regarding claim 20, see explanation as set forth regarding claim 14 (apparatus claim) because the claimed integrated circuit for a correction would perform the apparatus steps.

As for claim 35, Agee et al. teaches a communications apparatus wherein the transmitter output signal is an orthogonal frequency division multiplexing (OFDM) signal (Page 13, Para 0127-0128; Page 16, Para 0173; Page 19, Para 0210; Pages 24-25, Para 0270-0271; Page 33, Para 0398; Page 34, Para 0429; Page 35, Para 0453-0454; Pages 35-36, Para 0462-0465 of Agee et al.).

3. Claims 21-27 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Appel et al. (US Patent 6272336), Yun (US Patent 6463295), Wright et al. (US Patent 6054894) and further in view of Agee et al. (US Pub 2004/0095907).

As for claim 21, Appel et al. teaches a transmitter system comprising: means for determining an indication of power associated with a transmit output signal (Abstract; Col. 1, lines 7-10; Col. 6, lines 10-30; Col. 6, line 66-Col. 7, line 14; and Col. 7, lines 46-65 of Appel et al.) and means for compensating for distortion in the transmit output signal based on the indication of power (Col. 7, line 65-Col. 9, line 45 of Appel et al.).

What Appel et al. does not explicitly teach is the determining weights; frequency offset correction; equalization; demodulation; mitigating channel interference; using a pilot tone; and in one embodiment of the present invention, signal quality estimation.

However, Yun teaches a method for ongoing power control for a communication station with a multiple antenna array, the power control using a method for signal quality estimation applicable for angle modulated signals. One aspect of the ongoing power control method is applicable for the uplink and includes separating the joint determination of a receive weight vector and ongoing power control into a receive weight vector determining part and a separate transmit power adjustment part. In one embodiments, the ongoing power control method for the downlink includes separating the joint determination of a receive weight vector and ongoing power control into a receive weight vector determining part and a separate transmit power adjustment part. The method starts with one part, for example transmit power assignment. Receive weight vector determination is carried out with this assigned transmit power and the new weights used. An estimate of the resulting received signal quality is obtained and used for new ongoing power adjustment. Another aspect is applicable for the downlink and includes one aspect of the ongoing power control method is applicable for the uplink and includes separating the determination of a complete transmit weight vector including the vector of relative transmit weights and the scaling to use with the relative transmit weights into a part for determining a set of relative transmit weights and a separate transmit power adjustment part that determines the scaling factor. In addition, Yun teaches a <u>means for shaping a signal spectrum in the transmit output signal by</u>

<u>adjusting at least one of an in-phase (I) signal component and a quadrature (Q) signal component based on the indication of power</u> (Col. 27, lines 17-38; Col. 31, lines 30-53; Col. 35, lines 30-54; Col. 36, lines 11-30; and Col. 45, lines 26-31 & 35-58 of Yun).

What Appel et al. and Yun do not explicitly teach are the correcting impairments; a phase imbalance; and adjusting for any bulk gain mismatch.

However, Wright et al. discloses the mismatch correction and a control that can adjust one or both of I and Q signal components; correcting impairments; and reducing distortion. The inventive LINC amplifier provides substantially linear amplification from two nonlinear amplifiers by decomposing the original signal into two constant amplitude envelope, phase varying signals, which, when combined, constructively and destructively interfere to re-form the original signal. The output of the LINC amplifier, which is to be transmitted via an antenna, is an amplified form of the original signal. The inventive LINC amplifier utilizes a digital control mechanism to control and adapt a digital compensation network that directly compensates for the imperfections of the analog RF environment, including the amplifiers. The mechanism monitors the combined amplifier output and adjusts the signal components in order to precisely compensate for any differences in the characteristics of the separate signal paths which would cause the combination not to accurately represent the original signal. The mechanism also corrects the component signals using information which can be applied to the amplifiers independent of the signal to be transmitted.

What Appel et al., Yun, and Wright et al. do not explicitly teach is an equalization system and an OFDM tones.

Agee et al. teaches exploiting the substantive reciprocity of internode channel responses through dynamic, adaptive modification of receive and transmit weights, enables locally enabled global optimization of a multipoint, wireless electromagnetic communications network of communication nodes. Each diversity-channel-capable node uses computationally efficient exploitation of pilot tone data and diversity-adaptive signal processing of the weightings and the signal to further convey optimization and channel information which promotes local and thereby network-global efficiency. The preferred embodiment performs complex digital signal manipulation that includes a linear combining and linear distribution of the transmit and receive weights, the generation of piloting signals containing origination and destination node information, as well as interference-avoiding pseudorandom delay timing, and both symbol and multitione encoding, to gain the benefit of substantive orthogonality at the physical level without requiring actual substantive orthogonality at the physical level.

It would have been obvious to one of ordinary skill of the art at the time the invention was made to incorporate a network that employs power control system, as taught by Yun, in the traffic-weighted closed loop power detection system of Appel et al., because Appel et al. already teaches a power control circuit for controlling the transmitter output signal; correction systems; in-phase and quadrature signal; and compensation of power level (Abstract of Appel et al.).

The motivation of this combination would adjusts the power reference signal to compensate for changes in operating temperature and/or frequency and reduce power consumption, as taught by Appel et al. in Col. 10, lines 15-35, in order to maintain

constant gain in the transmit path. In addition, the power control would compensate the initial power control and ongoing power control. In initial power control, the goal is to initiate communications with the minimal level of power necessary to achieve an acceptable level of communications. Ongoing power control maintains minimum transmitted power usage on a link as the communication system changes over time by new links being formed while others are being established (Col. 1, lines 42-50 of Yun). With the power amplifier bias or power amplifier enable control signal unaffected by the distortion and the amplifiers can be smaller, cooler, more power efficient and less expensive. The preferred method of signal generation is to use digital techniques as much as possible to reduce distortions (Wright et al.). Appel et al., Yun, Wright et al., and Agee et al. each teach power amplifiers to compensate and/or reduce distortions/spikes in signal paths for a communication system and can further limit or reduce interference received at base stations or subscriber units (Page 2, Para 0017 of Agee et al.).

Claim 22, cancelled.

As for claim 23, Wright et al. teaches a transmitter system further comprising: means for, based on the indication of power, compensating for at least one of gain and phase mismatch associated with an in-phase signal path and a quadrature signal path of the transmitter system (Col. 13, lines 36-51 and Col. 42, line 56-Col. 43, line 48 of Wright et al.).

As for claim 24, Appel et al. and Wright et al. teach a transmitter system further comprising: means for mitigating spikes in a carrier signal of the transmit signal by

applying a DC signal to, based on the indication of power, adjust at least one of an in-phase (I) signal component and a quadrature (Q) signal component (Col. 7, line 46-Col. 10, line 4 of Yun in correspondence with Col. 7, lines 22-65; Col. 8, lines 3-27; Col. 13, line 52-Col. 14, line 3; Col. 24, lines 39-63; and Col. 44, line 57-Col.45, line 13 of Wright wt al.).

As for claim 25, Wright et al. teaches a transmitter system comprising: wherein the ~~impairments comprise~~ distortion in the transmit output signal comprises at least one of spikes in a carrier signal of the transmit signal, attenuation distortion in a signal spectrum corresponding to at least a portion of the transmit signal, a gain mismatch associated with an in-phase (I) signal path and a quadrature (Q) signal path, and a phase mismatch associated with the I-signal path and the Q-signal-path (Col. 7, lines 40-65 and Col. 42, line 56-Col. 43, line 48 of Wright et al.).

As for claim 26, Wright et al. teaches a transmitter system further comprising: means for calibrating the means for compensating to mitigate the ~~impairments~~ distortion in the transmit output signal (Col. 31, lines 30-53 and Col. 31, line 66-Col. 32, line 17 of Wright et al).

As for claim 27, Yun and Wright et al. teach a transmitter system comprising: the means for calibrating further comprising:

means for providing at least one calibration tone having an I-signal component and a Q-signal component (Col. 27, lines 17-38; Col. 31, lines 30-53; Col. 35, lines 30-54; Col. 36, lines 11-30; and Col. 45, lines 26-31 & 35-58 of Yun

in correspondence with Col. 7, lines 40-65 and Col. 42, line 56-Col. 43, line 48 of Wright et al.); and

means for adjusting at least one of the I-signal component and the Q-signal component based on the indication power, the means for compensating employing the adjusted at least one of the I-signal component and the Q-signal component to mitigate the ~~impairments~~ <u>distortion in the transmit output signal</u> (Col. 27, lines 17-38; Col. 31, lines 30-53; Col. 35, lines 30-54; Col. 36, lines 11-30; and Col. 45, lines 26-31 & 35-58 of Yun in correspondence with Col. 12, line 50-Col. 13, line 35 and Col. 42, lines 26-42 Wright et al.).

As for claim 36, Agee et al. teaches a transmitter system wherein the transmitter output signal is an orthogonal frequency division multiplexing (OFDM) signal (Page 13, Para 0127-0128; Page 16, Para 0173; Page 19, Para 0210; Pages 24-25, Para 0270-0271; Page 33, Para 0398; Page 34, Para 0429; Page 35, Para 0453-0454; Pages 35-36, Para 0462-0465 of Agee et al.).

4. Claims 28-33 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Appel et al. (US Patent 6272336), Yun (US Patent 6463295), Wright et al. (US Patent 6054894) and further in view of Agee et al. (US Pub 2004/0095907).

As for claim 28, Appel et al. teaches a method to correct impairments associated with a communications apparatus, the method comprising: detecting <u>power of a transmitter signal;</u> providing an indication of power ~~associated with a transmit signal~~ <u>for</u>

the transmitter output signal (Abstract; Col. 1, lines 7-10; Col. 6, lines 10-30; Col. 6, line 66-Col. 7, line 14; and Col. 7, lines 46-65 of Appel et al.); and selectively adjusting at least one of an in-phase (I) signal component and a quadrature (Q) signal component based on the indication of power to compensate for impairments associated with the communications apparatus that affect the transmit signal (Col. 7, line 65-Col. 9, line 45 of Appel et al.).

What Appel et al. does not explicitly teach is the determining weights; frequency offset correction; equalization; demodulation; mitigating channel interference; using a pilot tone; and in one embodiment of the present invention, signal quality estimation.

However, Yun teaches a method for ongoing power control for a communication station with a multiple antenna array, the power control using a method for signal quality estimation applicable for angle modulated signals. One aspect of the ongoing power control method is applicable for the uplink and includes separating the joint determination of a receive weight vector and ongoing power control into a receive weight vector determining part and a separate transmit power adjustment part. In one embodiments, the ongoing power control method for the downlink includes separating the joint determination of a receive weight vector and ongoing power control into a receive weight vector determining part and a separate transmit power adjustment part. The method starts with one part, for example transmit power assignment. Receive weight vector determination is carried out with this assigned transmit power and the new weights used. An estimate of the resulting received signal quality is obtained and used for new ongoing power adjustment. Another aspect is applicable for the downlink and

includes one aspect of the ongoing power control method is applicable for the uplink and includes separating the determination of a complete transmit weight vector including the vector of relative transmit weights and the scaling to use with the relative transmit weights into a part for determining a set of relative transmit weights and a separate transmit power adjustment part that determines the scaling factor. In addition, Yun teaches an applying weight factors to at least one of the I-signal component and the Q-signal component for tones that form a signal spectrum of the transmit signal for adjusting a spectral shape of the transmit signal (Col. 27, lines 17-38; Col. 31, lines 30-53; Col. 35, lines 30-54; Col. 36, lines 11-30; and Col. 45, lines 26-31 & 35-58 of Yun)

What Appel et al. and Yun do not explicitly teach are the correcting impairments; a phase imbalance; and adjusting for any bulk gain mismatch.

However, Wright et al. discloses the mismatch correction and a control that can adjust one or both of I and Q signal components; correcting impairments; and reducing distortion. The inventive LINC amplifier provides substantially linear amplification from two nonlinear amplifiers by decomposing the original signal into two constant amplitude envelope, phase varying signals, which, when combined, constructively and destructively interfere to re-form the original signal. The output of the LINC amplifier, which is to be transmitted via an antenna, is an amplified form of the original signal. The inventive LINC amplifier utilizes a digital control mechanism to control and adapt a digital compensation network that directly compensates for the imperfections of the analog RF environment, including the amplifiers. The mechanism monitors the combined amplifier output and adjusts the signal components in order to precisely

compensate for any differences in the characteristics of the separate signal paths which would cause the combination not to accurately represent the original signal. The mechanism also corrects the component signals using information which can be applied to the amplifiers independent of the signal to be transmitted.

What Appel et al., Yun, and Wright et al. do not explicitly teach is an equalization system and an OFDM tones.

Agee et al. teaches exploiting the substantive reciprocity of internode channel responses through dynamic, adaptive modification of receive and transmit weights, enables locally enabled global optimization of a multipoint, wireless electromagnetic communications network of communication nodes. Each diversity-channel-capable node uses computationally efficient exploitation of pilot tone data and diversity-adaptive signal processing of the weightings and the signal to further convey optimization and channel information which promotes local and thereby network-global efficiency. The preferred embodiment performs complex digital signal manipulation that includes a linear combining and linear distribution of the transmit and receive weights, the generation of piloting signals containing origination and destination node information, as well as interference-avoiding pseudorandom delay timing, and both symbol and multitione encoding, to gain the benefit of substantive orthogonality at the physical level without requiring actual substantive orthogonality at the physical level.

It would have been obvious to one of ordinary skill of the art at the time the invention was made to incorporate a network that employs power control system, as taught by Yun, in the traffic-weighted closed loop power detection system of Appel et

al., because Appel et al. already teaches a power control circuit for controlling the transmitter output signal; correction systems; in-phase and quadrature signal; and compensation of power level (Abstract of Appel et al.).

The motivation of this combination would adjusts the power reference signal to compensate for changes in operating temperature and/or frequency and reduce power consumption, as taught by Appel et al. in Col. 10, lines 15-35, in order to maintain constant gain in the transmit path. In addition, the power control would compensate the initial power control and ongoing power control. In initial power control, the goal is to initiate communications with the minimal level of power necessary to achieve an acceptable level of communications. Ongoing power control maintains minimum transmitted power usage on a link as the communication system changes over time by new links being formed while others are being established (Col. 1, lines 42-50 of Yun). With the power amplifier bias or power amplifier enable control signal unaffected by the distortion and the amplifiers can be smaller, cooler, more power efficient and less expensive. The preferred method of signal generation is to use digital techniques as much as possible to reduce distortions (Wright et al.). Appel et al., Yun, Wright et al., and Agee et al. each teach power amplifiers to compensate and/or reduce distortions/spikes in signal paths for a communication system and can further limit or reduce interference received at base stations or subscriber units (Page 2, Para 0017 of Agee et al.).

As for claim 29, Appel et al. and Wright et al. teach a method to correct impairments associated with a communications apparatus, further comprising applying

a DC offset for at least one of the I-signal component and the Q-signal component to mitigate spikes in a carrier for the transmit output signal (Col. 7, line 65-Col. 9, line 45 of Appel et al. with respect to Col. 7, lines 22-65; Col. 8, lines 3-27; Col. 14, line 38-Col. 15, line 5; and Col. 37, line 66-Col. 38, line 9 of Wright et al.).

As for claim 30, Wright et al. teaches a method to correct impairments associated with a communications apparatus, further comprising adjusting at least one of the I-signal component and the Q-signal component based on the indication of power to mitigate at least one of gain and phase mismatches associated with an I-signal path and a Q-signal path to which the respective I-signal component and the Q signal component are provided (Col. 7, lines 40-65 and Col. 42, line 56-Col. 43, line 48 of Wright et al.).

As for claim 31, Wright et al. teaches a method to correct impairments associated with a communications apparatus, further comprising:

determining an indication of a phase imbalance associated with the I-signal path and the Q-signal path (Col. 6, lines 7-28; Col. 8, lines 3-28; Col. 1, line 52-Col. 14, line 3; Col. 14, lines 39-50; Col. 24, lines 39-63; Col. 34, lines 15-36; Col. 37, line 66-Col. 38, line 9; and Col. 45, lines 35-58 of Wright et al.);

determining an indication of a gain mismatch associated with the I-signal path and the Q-signal path (Col. 13, lines 36-51 and Col. 42, line 56-Col. 43, line 48 of Wright et al.); and

calibrating the adjustments to the at least one of the I-signal component and the Q-signal component based on the indication of the phase imbalance and

the indication of the gain mismatch (Col. 7, lines 40-65; Col. 13, lines 36-51; and Col. 42, line 56-Col. 43, line 48 of Wright et al.).

Claim 32, cancelled.

As for claim 33, Yun teaches a method to correct impairments associated with a communications apparatus, further comprising determining a weight factor for each of the tones based on an indication of power associated with each respective one of the tones relative to an indication of power associated with a reference one of the tones (Col. 27, lines 17-38; Col. 31, lines 30-53; Col. 35, lines 30-54; Col. 36, lines 11-30; and Col. 45, lines 26-31 & 35-58 of Yun).

As for claim 37, Agee et al. teaches a method to correct impairments associated with a communications apparatus wherein the transmitter output signal is an orthogonal frequency division multiplexing (OFDM) signal (Page 13, Para 0127-0128; Page 16, Para 0173; Page 19, Para 0210; Pages 24-25, Para 0270-0271; Page 33, Para 0398; Page 34, Para 0429; Page 35, Para 0453-0454; Pages 35-36, Para 0462-0465 of Agee et al.).

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Doi (US Pub 2003/0104792) discloses a power calculating and amplitude limitation judging portion calculates the power value x of the digital quadrature baseband signal I, Q from a transmission data generator, and compares the power

value x with a power threshold value y set by a threshold value setting portion to judge whether amplitude limitation is needed or not. An amplitude maximum limiting portion subjects the quadrature baseband signal from the transmission data generator to the amplitude maximum value limitation based on the judgment result in the power calculating and amplitude limitation judging portion. Thereafter, the digital quadrature baseband signal which has been subjected to the amplitude maximum value limitation by the amplitude maximum value limiting portion is subjected to the distortion compensation using complex multiplication based on the distortion compensation data by a non-linear distortion compensation calculator

Nolan et al. (US Patent 7013257) discloses a communication system emulator digitally emulates a plurality of signal impairments created by the transmitter and receiver components and communication medium in a typical communication system, for use in evaluating and refining modem design. A variety of linear and non-linear distortion characteristics are impressed on baseband signals between modulators and demodulators to evaluate and refine modem performance without requiring transmission frequency components or communication channel. The emulator comprises transmit modules, receive modules and communication media modules, and can accept or output analog or digital signals. Each module is configurable to allow modeling of simplex or duplex communication or a common base station with multiple users transmitting or receiving, all configurations with or without communication media impairment emulation. Each module can be configured to add a plurality of linear and non-linear impairments to a baseband signal.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Janelle N. Young whose telephone number is (571) 272-2836. The examiner can normally be reached on Monday through Friday: 9:30 am through 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nay Maung can be reached on (571) 272-7882. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JNY
January 11, 2008

NAY MAUNG
SUPERVISORY PATENT EXAMINER